

What is claimed is:

1. A micro-electromechanical system (MEMS) device, comprising:
a pair of spaced apart top and bottom substrates having mutually opposing inner surfaces;
- 5 a micro-machined electromechanical device mechanism coupled to the inner surface of one of the top and bottom substrates;
a metal chip bond pad formed on the inner surface of the bottom substrate and being electrically coupled to an electrical path;
a metal chip bond pad formed on the inner surface of the top substrate in a
10 complementary position opposite the chip bond pad on the bottom substrate; and
a gold stud bump mechanically and electrically coupled between the chip bond pads on the top and bottom substrates.
2. The device of claim 1 wherein the top and bottom substrates are symmetrically spaced from active surfaces of the micro-machined electromechanical device.
- 15 3. The device of claim 1, further comprising a metal wire bond pad formed on the inner surface of the bottom substrate remote from the device mechanism and being electrically coupled to the electrical path.
4. The device of claim 1, further comprising an electrical path formed on the inner surface of the top substrate and being electrically coupled to the chip bond pad.
- 20 5. The device of claim 4 wherein the electrical path formed on the inner surface of the top substrate is further electrically coupled to an upper surface of the device mechanism.
6. The device of claim 5 wherein the electrical path formed on the inner surface of the bottom substrate is further electrically coupled to a lower surface of the device mechanism.
7. The device of claim 1, further comprising a mesa formed on the inner surface of one
25 of the top and bottom substrates.
8. The device of claim 7 wherein the mesa further comprises a continuous mesa completely surrounding the device mechanism.

9. The device of claim 8, further comprising a seal formed between the mesa and the inner surface of one of the top and bottom substrates.
10. A micro-electromechanical system (MEMS) device, comprising:
first and second spaced apart substrates having first and second mutually opposing
5 inner surfaces;
a semiconductor silicon mechanism substrate mechanically coupled to one of the inner surfaces and having a micro-electromechanical device mechanism patterned therein;
a plurality of pairs of complementary chip bond pads formed on the first and second mutually opposing inner substrate surfaces;
- 10 a gold stud bump thermocompressively or ultrasonically coupled between each of the pairs of complementary chip bond pads.
11. The device of claim 10, further comprising:
a first electrical conductor formed on the first of the mutually opposing inner substrate surfaces and being electrically coupled to a first one of the chip bond pads of one of
15 the pairs of complementary chip bond pads;
and a second electrical conductor formed on the second of the mutually opposing inner substrate surfaces and being electrically coupled to a second one of the pair of complementary chip bond pads.
12. The device of claim 11 wherein each of the first and second electrical conductors
20 further comprises an electrical contact being electrically coupled to the device mechanism.
13. The device of claim 11 wherein one of the first and second electrical conductors further comprises a conventional wire bond pad formed on the corresponding inner substrate surface at a position remote from the device mechanism.
14. The device of claim 13 wherein a different one of the first and second electrical
25 conductors further comprises an electrical contact being electrically coupled to the device mechanism.
15. The device of claim 11, further comprising an electrode formed on one of the first and second mutually opposing inner substrate surfaces opposite from a portion of the device

mechanism and being electrically coupled to a corresponding one of the first and second electrical conductors.

16. The device of claim 10 wherein the first and second mutually opposing inner substrate surfaces are spaced substantially symmetrically from respective first and second surfaces of the mechanism substrate.

17. The device of claim 16, further comprising one or more mesas formed between the first and second mutually opposing inner substrate surfaces.

18. The device of claim 17, further comprising a hermetic seal between the first and second mutually opposing inner substrate surfaces and completely surround the micro-electromechanical device mechanism.

19. A micro-electromechanical system (MEMS) capacitive acceleration sensor device, comprising:

a pair of mutually spaced apart first and second substrates having mutually opposing inner surfaces;

15 a semiconductor silicon mechanism substrate mechanically coupled to one of the inner surfaces and having a micro-machined capacitive acceleration sensor mechanism patterned therein;

one or more electrodes formed on each of the first and second mutually opposing inner substrate surfaces;

20 one or more pairs of complementary metal chip bond pads formed on the first and second mutually opposing inner substrate surfaces;

an electrically conductive path formed between one of the electrodes and one of the chip bond pads on a corresponding one of the first and second mutually opposing inner substrate surfaces;

25 a gold stud bump electrically and mechanically coupled between each of the pairs of complementary metal chip bond pads; and

one or more mesas spacing the electrodes on the first and second mutually opposing inner substrate surfaces substantially symmetrically from respective first and second surfaces of the capacitive acceleration sensor mechanism.

20. The device of claim 19, further comprising an electrically conductive path coupled between the capacitive acceleration sensor mechanism and one of the chip bond pads.

21. The device of claim 19, further comprising:

a plurality of wire bond pads formed on one of the first and second mutually opposing
5 inner substrate surfaces; and
an electrically conductive path formed between one of the chip bond pads and one of the wire bond pads.

22. The device of claim 21 wherein:

the semiconductor silicon mechanism substrate having the micro-machined capacitive
10 acceleration sensor mechanism patterned therein is mechanically coupled to the inner surface of the first substrate;

the one or more mesas extend from the inner surface of the first substrate; and

the plurality of wire bond pads are formed on the inner surface of the second substrate in an area remote from the sensor mechanism.